$$W = \sum_{i=1}^{3} \sum_{j=1}^{n} \frac{\mu_j}{\alpha_j}\left(\lambda_i^{*\alpha_j} - 1\right) + K\left(J - 1 - \ln J\right)$$

$$\lambda_i = \frac{l_i}{l_{i0}}; \qquad J = \lambda_1 \lambda_2 \lambda_3 = \frac{V}{V_0}; \qquad \lambda_i^* = \lambda_i J^{-1/3}$$

$$\sigma_i = \sum_{j=1}^{n} \frac{\mu_j}{J}\left[\lambda_i^{*\alpha_j} - \sum_{k=1}^{3} \frac{\lambda_k^{*\alpha_j}}{3}\right] + K\frac{J-1}{J}$$

110

$$f(\lambda_i) = \sum_{j=1}^{n} \mu_j \lambda_i^{*\alpha_j}$$

120

$$\sigma_{0i} = \frac{1}{\lambda_i}\left(f(\lambda_i) - \frac{1}{3}\sum_{k=1}^{3} f(\lambda_k) + K\frac{J-1}{J}J\right)$$

$$\sigma_i = \frac{1}{J}\left(f(\lambda_i) - \frac{1}{3}\sum_{k=1}^{3} f(\lambda_k)\right) + K\frac{J-1}{J}$$

130

FIG. 1

210

$$\lambda_3 = \lambda_{longitudinal} = \lambda < 1$$

$$\lambda_1 \lambda_2 \lambda_3 = 1; \qquad \lambda_1 = \lambda_2 = \frac{1}{\sqrt{\lambda_3}} = \lambda_3^{-1/2} = \lambda^{-1/2}$$

$$\sigma_0(\lambda) = \frac{1}{\lambda}\left(\frac{2}{3} f(\lambda) - \frac{2}{3} f\left(\lambda^{-1/2}\right) + K \frac{J-1}{J} J\right)$$

$$\varepsilon_0 = \lambda - 1; \qquad p = K \frac{J-1}{J}$$

$$\sigma_0(\varepsilon_0) = \frac{1}{\lambda}\left(\frac{2}{3} f(\lambda) - \frac{2}{3} f\left(\lambda^{-1/2}\right) + pJ\right)$$

$$\frac{\lambda \sigma_0(\varepsilon_0)}{J} - p = \frac{1}{J}\left(\frac{2}{3} f(\lambda) - \frac{2}{3} f\left(\lambda^{-1/2}\right)\right)$$

220

$$\lambda \sigma_0(\varepsilon_0) = f(\lambda) - f\left(\lambda^{-1/2}\right)$$

230

FIG. 2

$$\lambda\sigma_0(\lambda-1)=f(\lambda)-f\left(\lambda^{-1/2}\right)$$
$$\lambda^{-1/2}\sigma_0\left(\lambda^{-1/2}-1\right)=f\left(\lambda^{-1/2}\right)-f\left(\lambda^{1/4}\right)$$
$$\lambda^{1/4}\sigma_0\left(\lambda^{1/4}-1\right)=f\left(\lambda^{1/4}\right)-f\left(\lambda^{-1/8}\right)$$
....
$$f(\lambda)=\lambda\sigma_0(\lambda-1)+\lambda^{-1/2}\sigma_0\left(\lambda^{-1/2}-1\right)+\lambda^{1/4}\sigma_0\left(\lambda^{1/4}-1\right)+\ldots$$

310

$$\varepsilon_{0i}=\lambda_i-1$$
$$f(\lambda_i)=\lambda_i\sigma_0(\varepsilon_{0i})+\sum_{m=1}^{\infty}\lambda_i^{(-1/2)^m}\sigma_0\left(\lambda_i^{(-1/2)^m}-1\right)$$

320

$$\sigma_{0i}=\frac{1}{\lambda_i}\left(f(\lambda_i)-\frac{1}{3}\sum_{k=1}^{3}f(\lambda_k)+K\frac{J-1}{J}J\right)$$
$$\sigma_i=\frac{1}{J}\left(f(\lambda_i)-\frac{1}{3}\sum_{k=1}^{3}f(\lambda_k)\right)+K\frac{J-1}{J}$$

330

FIG. 3

430

$$\varepsilon_{0\min} = \min\left(\varepsilon_{0c}, \frac{1}{\sqrt{\varepsilon_{ot}+1}} - 1\right)$$

$$\varepsilon_{0\max} = \max\left(\varepsilon_{0t}, \frac{1}{\sqrt{\varepsilon_{oc}+1}} - 1\right)$$

$$\varepsilon_0 = \lambda - 1$$

Typical strain range from -0.8 to 1.2

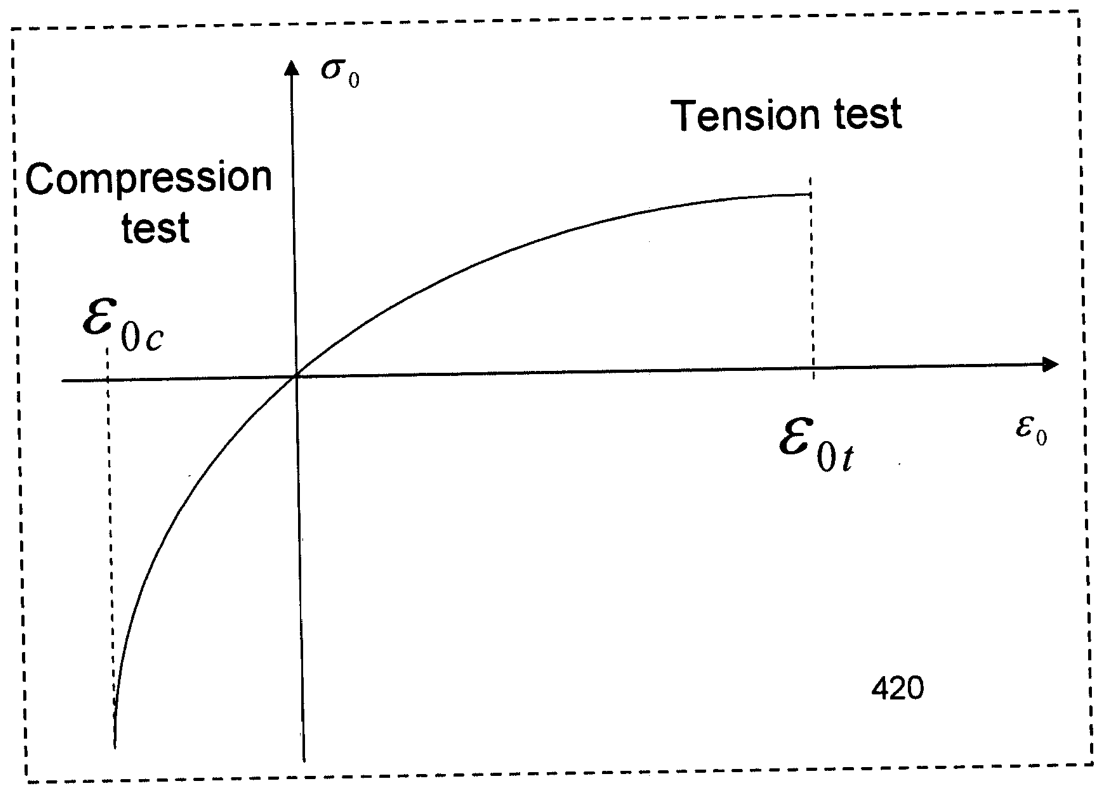


FIG. 4

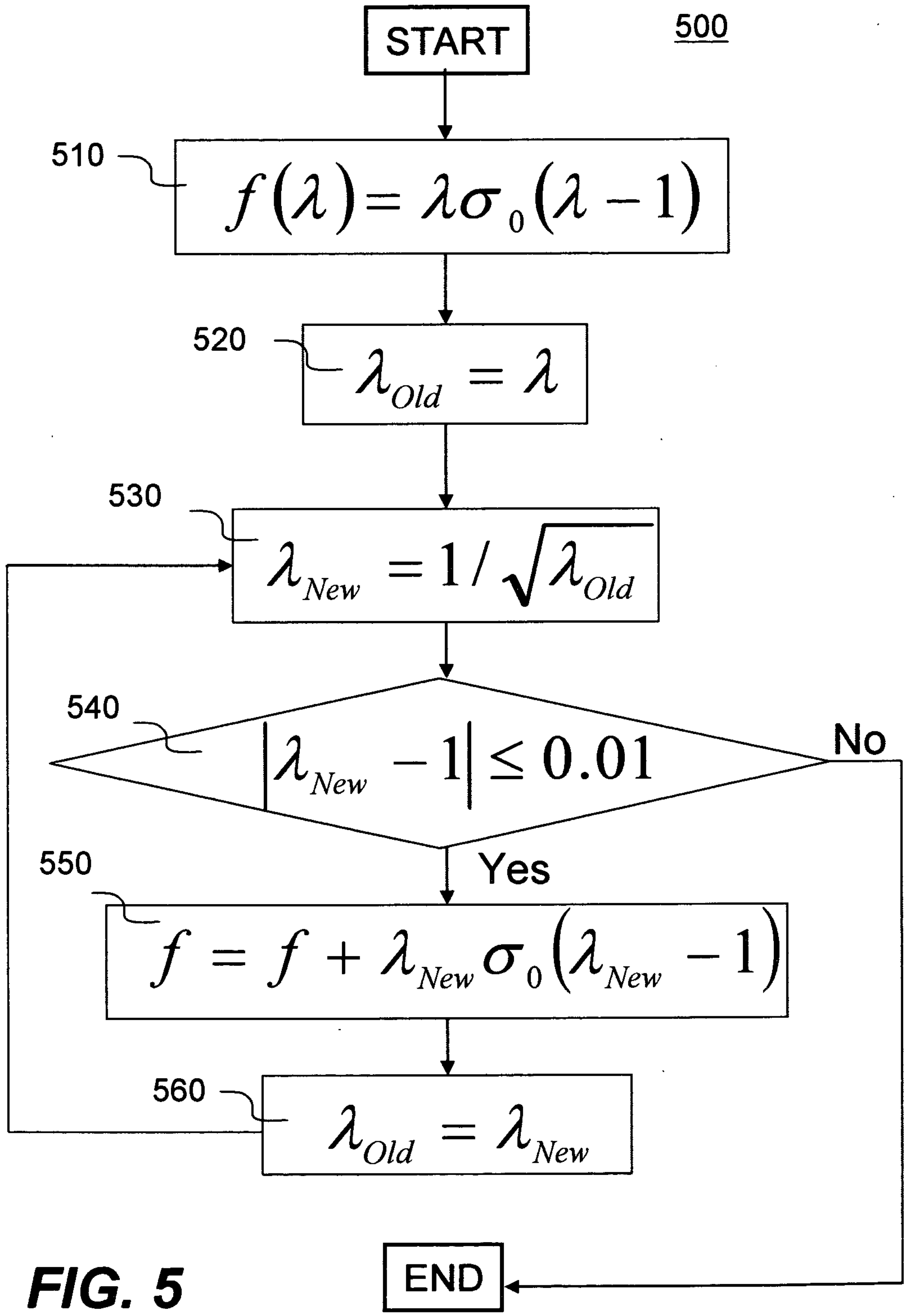
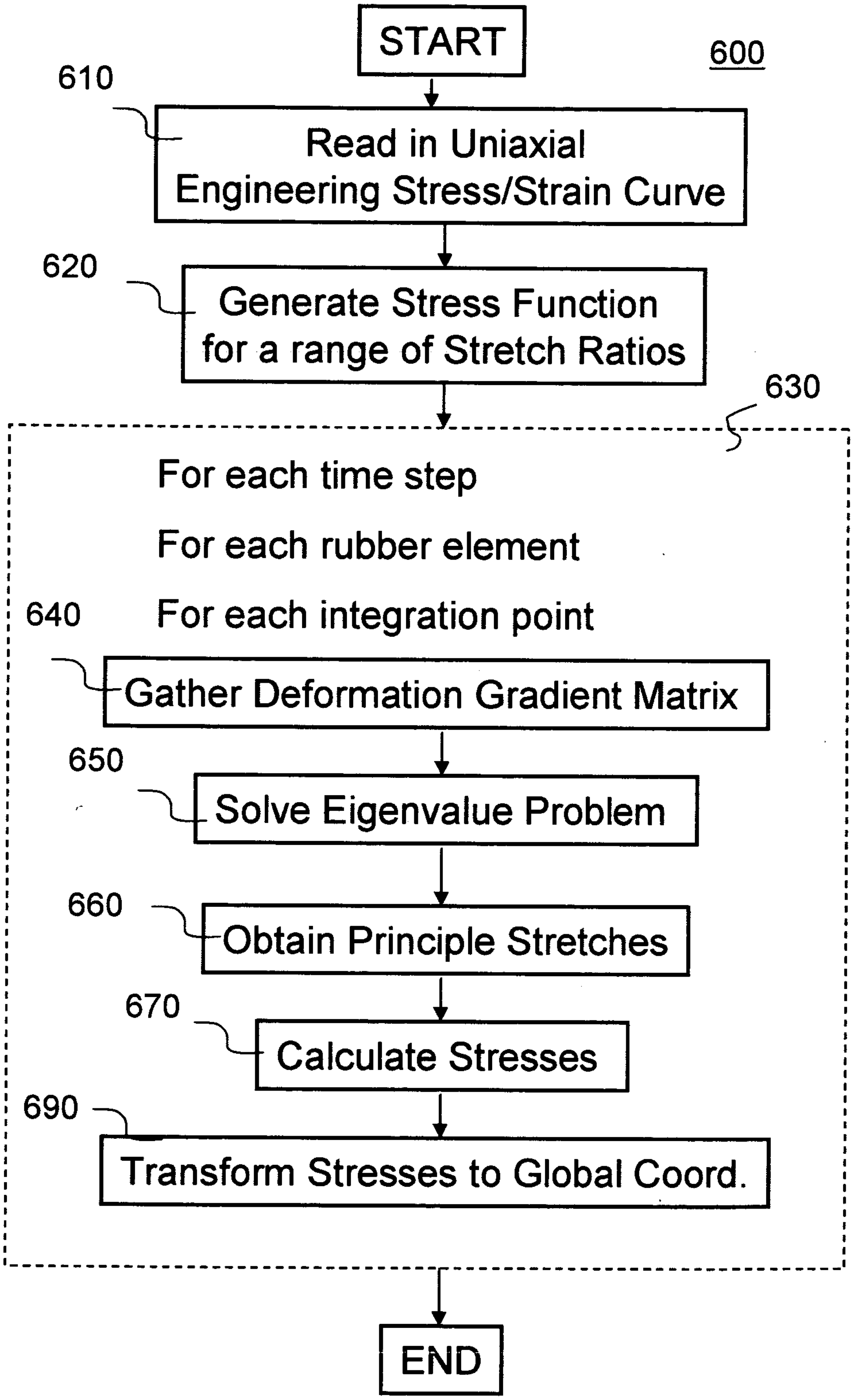

START
500
510
$f(\lambda) = \lambda\sigma_0(\lambda - 1)$
520
$\lambda_{Old} = \lambda$
530
$\lambda_{New} = 1/\sqrt{\lambda_{Old}}$
540
$|\lambda_{New} - 1| \leq 0.01$
No
Yes
550
$f = f + \lambda_{New}\sigma_0(\lambda_{New} - 1)$
560
$\lambda_{Old} = \lambda_{New}$
END

FIG. 5



START
600
610
Read in Uniaxial Engineering Stress/Strain Curve
620
Generate Stress Function for a range of Stretch Ratios
630
For each time step
For each rubber element
640
For each integration point
Gather Deformation Gradient Matrix
650
Solve Eigenvalue Problem
660
Obtain Principle Stretches
670
Calculate Stresses
690
Transform Stresses to Global Coord.
END

FIG. 6

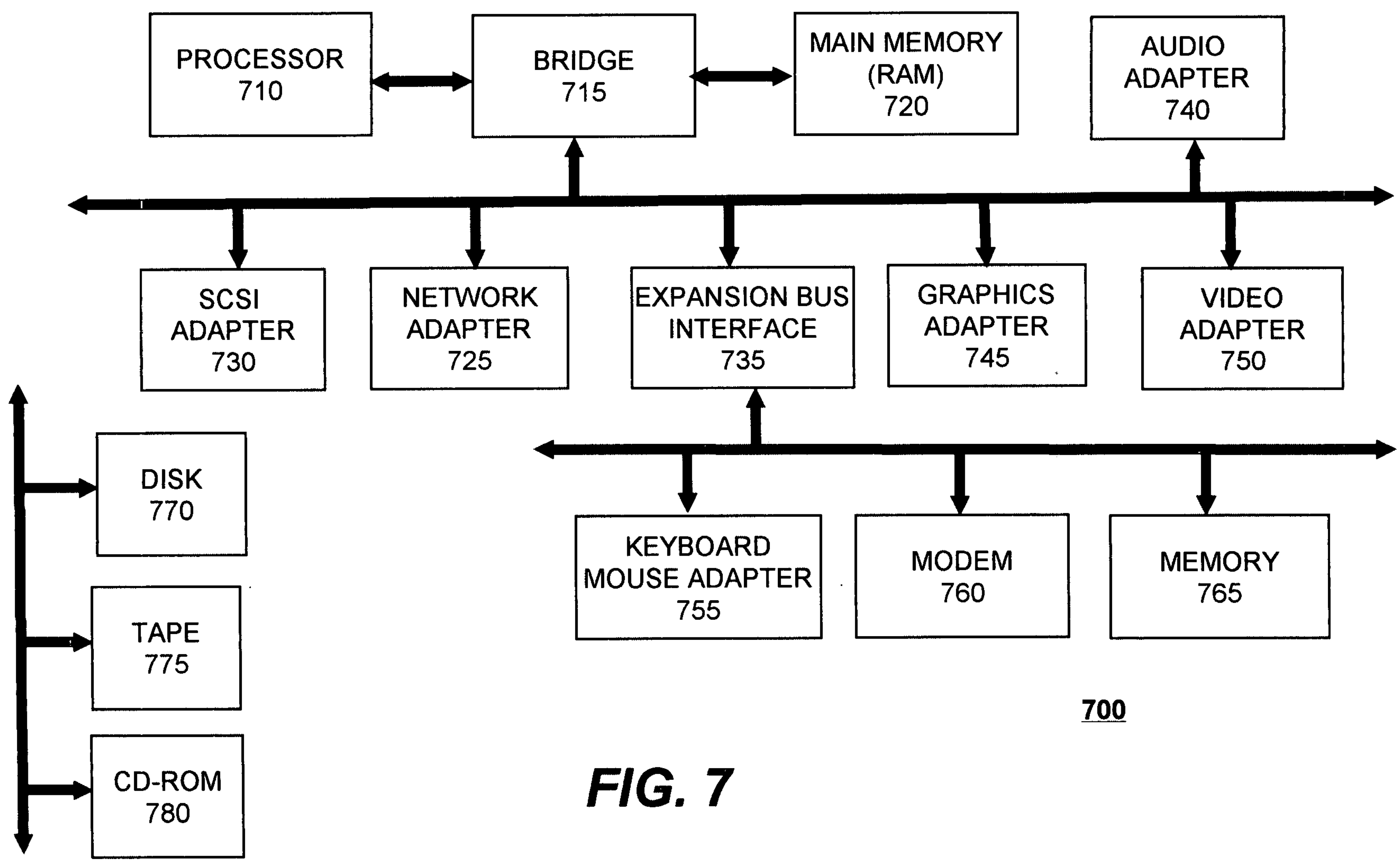

PROCESSOR
710
BRIDGE
715
MAIN MEMORY
(RAM)
720
AUDIO
ADAPTER
740
SCSI
ADAPTER
730
NETWORK
ADAPTER
725
EXPANSION BUS
INTERFACE
735
GRAPHICS
ADAPTER
745
VIDEO
ADAPTER
750
DISK
770
TAPE
775
CD-ROM
780
KEYBOARD
MOUSE ADAPTER
755
MODEM
760
MEMORY
765
700

FIG. 7